

Cultural Variable and Functional Probability Learning: An Ethnomathematics Perspectives

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doi: <https://doi.org/10.37745/ijmss.13/vol11n2112>

Published June 20 2023

Citation: David O.U. and Udom U.D. (2023) Cultural Variable and Functional Probability Learning: An Ethnomathematics Perspectives, *International Journal of Mathematics and Statistics Studies*, Vol.11, No.2, pp.1-12

ABSTRACT: *The crux of this study investigated “cultural variable and functional probability learning: An Ethnomathematics perspectives”. Nsa Isong game was used as major independent variable and functional probability learning as dependent variable. Two (2) purpose of the study was used to generate two (2) research questions and two (2) null hypotheses were formulated for the study. The Quasi-experimental design of pretest and posttest was adopted for the study with a proportionate stratified sampling technique used to obtain a sample size of 320 students from a population of 3,610 students. Probability Achievement Test (PAT) was the instrument used for data collection with a reliability coefficient of 0.87 using split half reliability test. Data collected from the study were subjected to analysis of covariance (ANCOVA) for analysis. The results indicated that; there is significant effect of Nsa Isong game on students’ functional probability learning, there is significant effect of Nsa Isong game and gender on students’ functional probability learning. Based on this result obtained it was recommended amongst others that workshops and seminars should be organize for teachers at primary and secondary level of education on how to use the Nsa Isong game in the teaching and learning of probability.*

KEYWORDS: cultural variable, Nsa Isong, functional probability, ethnomathematics

INTRODUCTION

Mathematics pervades everyday life, sometimes obviously and at other times on a more hidden or implicit level. Mathematics is a discipline which deals with numbers, figures, symbols, signs, space, structure, et cetera. According to Orok, Udom and Eduok (2010), Mathematics is a course or subject that prepares a child for useful living which in this case is self-reliant. They observed that mathematics processes such as counting, addition, subtraction, multiplication, division, weighing, measuring etcetera, have immense practical value in real life situations. Besides,

mathematics is the science of patterns and relationship. It is the language and logic of our technological world. Mathematical power is the ability to explore, to conjecture, to reason logically and to use a variety of mathematical methods in solving real life problems (Ale & Adetula, 2010). Probability is one of the six (6) strands (themes) being captured in the new revised Mathematics curriculum for Senior Secondary Schools. This is a branch of mathematics that deals with chances, likelihood and logic. According to Oxford Dictionary it is that area of mathematics, showing the chances that a particular thing will happen. According to Umoren and Iwundu (2007), probability is the study of non-deterministic or random experiments. By random experiment they mean a statistical process that can be repeated such that in any single trial, the outcome or result is unpredictable. For example, in a single throw of a fair dice, a player does not know the result until after the throw. Experiments in which the result or outcomes are not known a priori are called non-deterministic or random experiments, it is this concept of probability that “Nsa Isong” as a cultural variable will be used to address. For students to really understand the concept of probability, the concept of Ethnomathematics must come to play.

Ethnomathematics is that mathematics which is practiced among identifiable cultural groups, such as national, tribal societies, labour groups, children of a certain age bracket, professional classes etc. Its identity depends largely on focuses of interest, on motivation, and on certain codes, jargons which do not belong to the realm of academic mathematics (Hammond, as cited by Enuokoha, 2010). This implies that ethnomathematics is that mathematics learning which the students derive the sources of learning from local resources within the cultural setting of the learners. Hence, in terms of probability learning, “Nsa Isong”, a popular folk game among the South-South and the South East region of Nigeria will help.

“Nsa Isong” is a game which can be played by 2 or 3 persons at a time. It is interesting and motivating. It has 12 cells (holes). If 2 persons, each person will have 6 cells, if 3 persons, each person will have 4 cells. This will be demonstrated during the treatments. In addition, functional probability learning according to this study refers to the academic achievement of students in probability learning. To determine the effectiveness of this game in probability learning, two moderator variable was considered; gender and school location. Here, gender is defined in term of male and female students under investigation while school location is defined in term of urban and rural schools under investigation.

Probability being one of the strands of mathematics should be encouraged from the environmental and cultural civilization of the child (ethnomathematics). Therefore, this research work focuses on “cultural variable and functional probability learning”: An Ethnomathematics perspectives.

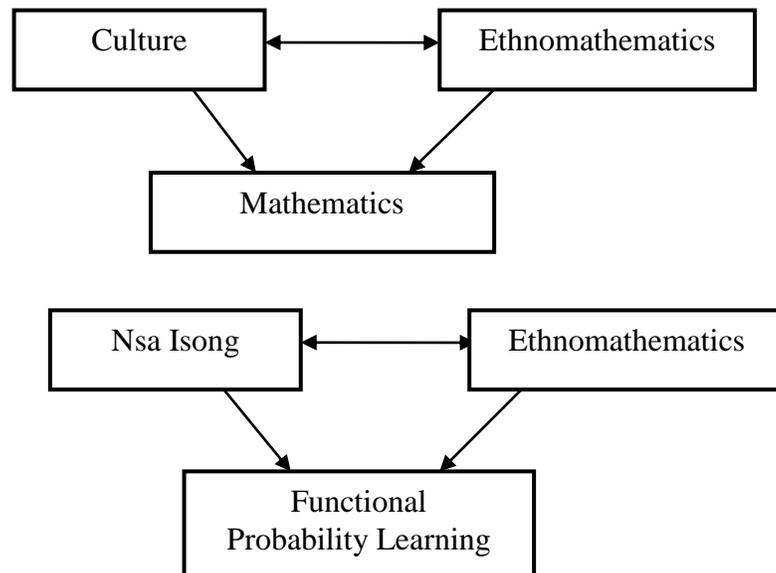
Nsa Isong Game (Ethnomathematics) and Students Functional Probability Learning

Nsa Isong as a concept of ethnomathematics is a game which can be played by two

(2) or three (3) persons depending on the circumstances. This game is popular among South South and South East Region of Nigeria which Akwa Ibom State is part of. Ethnomathematics is the study of the culturally related aspects of mathematics.

It deals with the comparative study of mathematics of different human cultures, especially with regard to how mathematics has shaped, and in turn has been shaped by, the values and beliefs of groups of people (Hammond, 2000, p. 78).

Hammond demonstrated ethnomathematics thus:



However, this research will capture its own as;

This implies that Nsa Isong is from the cultural background which is ethnomathematics and functional probability learning from the official realm of mathematics.

Beside, Erukoha (1995) defined ethnomathematics as a discipline interested in the study of mathematics and mathematics education in the cultural milieu (Environment) of the learner. According to Orok, (2013), Nsa Isong being a concept of ethnomathematics especially in the learning of probability, is a game with two sides, each side having six (6) holes with four smooth circular objects in each hole. This makes a total of 12 holes with 48 smooth circular objects, usually played by 2 or 3 persons. According to Orok, this game allows for addition, subtraction, multiplication and division as concepts in mathematics. Above all, this game may enhance knowledge in areas of probability vis-à-vis mathematics.

Nsa Isong Game, Gender and Students Functional Probability Learning

John (2015) in his study titled Gender Differences in mathematics Achievement and Retention scores, stressed that male and female students taught algebra using Problem- Based Learning (PBL) did not significantly differ in achievement and retention scores, thereby revealing that male and female students are capable of competing in mathematics. The design of the study was pretest-post test quasi - experimental design. Four hundred and twenty eight (428) Senior Secondary One (S.S.I) students from ten public secondary schools form the sample size of the study. This comprised of two hundred and sixty one (261) male students and one hundred and sixty seven (167) female students. The study adopted Algebra Achievement Test (AAT) as the instrument. Two research hypotheses were analyzed using t-test at 0.05 level of significance.

Blinkhorn (2006) in the study “comparing the Mean (\bar{x}) general academic performance scores of male and female students in mathematics”. The analysis showed a significant gender difference with the males having a higher means scores ($\bar{x} = 38.80$; $SD = 9.16$) than the female ($\bar{x} = 36.04$; $SD = 7.86$). The mean difference yielded F-ratio of 2.37 at 0.05 level of significance and 218 degree of freedom. The sample size was 220 students. This result suggested that male students performed better in their academic subjects than their female counterparts. The result of the analysis when comparing the gender difference on mathematics performance showed a significance gender difference.

A study by Oche (2012) on the “relative effectiveness of three teaching strategies on 150 mathematics students randomly selected from three secondary schools in Ogbodibo Local Government Area of Benue State.” A 25 item Achievement Test in Mathematics (ATM) was adopted for data collection. The study was analyzed using analysis of covariance (ANCOVA). The finding showed no significant difference in mean achievement between males and females students when taught using activity method while significant difference exist in mean achievement scores of male and female students taught using lecture strategy. Hence demonstration strategy was more gender friendly than lecture strategy. The result confirmed with the reports of Vale (2009) and Archibong (2009) who found no gender difference in academic performance of male and female students but at variance with Yoyobe (2004) and Ajibade (2009) who observed significance effect of gender on students’ academic performance in favour of female and male students respectively. A study by Dania (2014) on the “Effect of Gender on Students Academic Achievement in Secondary School Social Studies”. The study adopted a quasi-experimental design (2x2 non - randomized pre-test, post-test control group), comprising six groups made up of four experimental groups and two control groups. Six schools and one hundred and eighty (180) upper basic 2 students in Delta and Edo States made up the sample size for the study. Six intact classes were randomly selected and assigned to experimental and control groups. The study adopted the Social Studies Achievement Test (SSAT). The validity and reliability of the instrument were established. The reliability of the instrument was established using Pearson Product Moment Correlation Coefficient (r). And the reliability coefficient obtained was 0.79. Means (x), Standard Deviation

(SD), Analysis of Covariance (ANCOVA) were used to analyze the data. The results showed that: gender (male/female) had no significant effect on students' achievement in social studies and finally, result showed that there was significant interaction effect of treatment and gender on students' academic performance in social studies.

Statement of the Problem

There has been a drastic reduction in the standard of academic achievement by students at all levels of education in Nigeria in the past decades (Awofola, 2012). This poor performance of students in both internal and external examinations in Nigeria, especially Mathematics, is of great concern to the government, parents and well-meaning Nigerians.

The West African Senior Secondary Certificate Examination (WASSCE) Chief Examiners Report (2015) identified probability, word problems, Menstruation etc as areas which candidates are finding it difficult to break through. Probability is a strand in mathematics that aid in the study of statistics especially during research and experimentation. It also helps in the area of prediction in an organization that deals with production of items or materials. As important as probability is to our national life, students still fail examination on it. This may be as a result of teaching and learning of probability in abstraction without linking it to real life situation, especially that which relates to the learners' environment. Therefore, this research work will look at the effectiveness of "Nsa Isong" as a cultural variable on functional probability learning in Mathematics.

Purpose of the study

The main objective of this research work was to determine the effect of cultural variable (Nsa Isong) "on functional probability learning among Junior Secondary II Students in Etinan Education Zone of Akwa Ibom State. Considering the main independent variable - (Nsa Isong) with the one (1) moderator variables (Gender), the following are the specific objectives of the study:

1. To examine the effect of Nsa Isong (treatment) on functional Probability learning.
2. To examine the effect of treatment and Gender on functional Probability learning.

Research Questions

The following research questions were formulated to guide the study:

1. What is the main effect of treatment (Nsa Isong game) on students functional probability learning?
2. What is the interactive effect of treatment and gender on students' functional probability learning?

Statement of Hypotheses

The following statement of hypotheses were formulated to guide the study:

1. There is no significant effect of Nsa Isong game (treatment) on students' functional probability learning.

2. There is no significant interactive effect of treatment (Nsa Isong game) and gender on students' functional probability learning.

METHODS

The design for this study was a two-group design of quasi-experimental and control groups, design was used for this study. This design make used of pretest and posttest in order to ascertain the effect of treatment together with the moderator variables. The population of this study comprise of 3610 JSS II students comprising of 2400 male and 1210 female students as at 2018/2019 academic year, (Akwa Ibom State Universal Basic Education Board — AKSUBEB) in the thirty (30) public secondary schools of the three (3) local government area (Etinan, Nsit Ibom and Nsit Ubium) making up etinan education zone.

The proportionate and stratified random sampling techniques were used to select a sample of three hundred and twenty (320) junior secondary two (JSS 2) students drawn from intact classes from the eight (8) selected schools in Etinan Education Zone. The samples were 152 males and 168 female students. In term of groups; 160 were assign to experimental group and 160 for control group.

The instrument for data collection for this study was Probability Achievement Test (PAT). This instrument was developed by the researcher. The instrument has two (2) parts: part A elicited information on students, and gender and part B consisted of twenty (20) question items under the concept of probability as stated under delimitation of the study. Some of the questions were adapted from Past Basic Education Certificate (BECE) examination questions that were related to concept of probability. This instrument was validated and the reliability of The data obtained was subjected to split-half reliability test to determine the reliability index of the instrument, which was 0.87. The students were given code numbers to use in their scripts instead of their name. These code numbers were maintain in the pretest and posttest exercises. The instrument was expected to measure the students, pretest and posttest achievement in the experimental and control groups.

Table 1: Split-half reliability estimates of the research instrument (N 50)

Instrument	No of item	Type	Mean (\bar{x})	Standard derivation (SD)	Split-half correlate (r _{xy})	Reliability estimate (r _{tt})
	25	Odd	121.37	1.40	.82	.87
	25	Even	130.55	26.54		

Treatment

- (i) Permission was obtained from the authorities of the selected schools.
- (ii) Interaction between the researcher and the mathematics teachers who taught the students on the concept of probability.

(iii) Administration of pre-test: The PAT was administered to the entire groups by the researcher assisted by the mathematics teachers. The scripts were collected immediately after the test completion for marking.

(iv) Treatment: The active classroom teaching commenced two days after the pretest administrations. The teaching exercises were done by the mathematics teachers of each school. The instructional packages of the study consisted of the lesson notes for experimental group using Nsa Isong game and that of the control group using lecture teaching method.

(v) Administration of Post-test: After the active classroom teaching exercise, the PAT was reshuffled and administered as posttest four days after the conclusion of treatment exercise. The test scripts were collected for marking and analysis.

For each correct option to items in PAT was scored 5 marks and incorrect answer was scored zero (0). For gender Male were scored – 1 and Female –2. The research questions were answered using descriptive statistics (means and standard derivation), while the relevant null hypotheses (1 - 4) stated, were tested using Analysis of Covariance (ANCOVA) at p-value = 0.05. This method of data analysis helps to eliminate differences between groups.

RESULTS

The major independent variables of the study were cultural variable (Nsa Isong game). The independent variable was categorized into experimental and control group. The experimental group were taught the concept of probability using “Nsa Isong game” while control group were taught the same concept of probability using lecture method. The moderator variables were gender (male and female). The dependent variable was functional probability learning in mathematics which according to this study mean students’ academic achievement.

Results of data analysis are presented in Table 2 and the result of the tested null hypotheses are presented in Table 3. Table 4 shows summary of analysis of covariance on posttest scores according to treatment, and gender in terms of adjusted mean, Eta and Beta.

Table 2 shows posttest and pretest scores in terms of treatment (Nsa Isong game) in experimental group and non-treatment in control groups, and gender in terms of moderator variables. From the table, the academic achievement gain is established that is posttest minus pretest as seen in the last column of the table. The implication is that there is significant improvement when Nsa Isong game is used than when lecture method is used.

Table 2: Post-test and pre-test scores in terms of treatment genders and school location

Variables	Group	N	Post-test score	Pre-test score	Achievement gain (Posttest-Pretest)
Treatment	Experimental	160	39.37	20.02	19.25
	Control	160	27.20	16.10	11.10
Gender	Male	152	35.21	18.05	17.16
	Female	168	31.35	18.07	13.28

Table 3: Summary of analysis of co-variables

Source of variance	Sum of square	df	Means square	F-ratio	P-level
Intercept	996.822	1	996.822	30.028	.000
Pretest	141.692	1	141.692	4.268	.040
Main effect					
Treatment	234.676	1	234.676	7.069	.008
Gender	459.474	1	459.474	89.747	.000
2-way interaction effect					
2. Treatment x Gender	469.474	1	469.474	13.541	.000
Model	14015.663	9	1557.296	46.911	.000
Residual	7635.271	130	33.197		
Total	21750.934	139			

Model Goodness of fit $R = .913$, square = .833

Table 4: Summary of Analysis of covariance on post test scores according to treatment, gender and school location groups

Variables	Groups	N	Unadjusted mean	Adjusted mean	Eta	Beta
Treatment	Experimental	160	39.27	38.48	.903	.910
	Control	160	27.20	30.98		
Gender	Male	152	35.21	33.94	.074	.062
	Female	168	31.35	32.56		

Hypothesis One: There is no significant effect of Nsa Isong game (treatment) on students functional probability learning.

To test this hypothesis, analysis of covariance was used. The result as presented in Table 3, shows that there is significant main effect of Nsa Isong game (treatment) $F(1, 139) = 7.069$, ($P < 0.05$) on academic achievement of students in probability. This result indicated that experimental and control groups differ significantly from one another in academic achievement in probability. On the basis of this result, hypothesis 1 is therefore rejected. This implies that the alternate hypothesis

1 is upheld. To show the direction of difference, multiple classification analysis was applied to the data (see Table 4). The result indicates that the adjusted mean scores for the experimental group performed significantly better than their counterparts in the control group (35.48 and 30.98 respectively). Hence, research question 1 (what is the main effect of treatment (Nsa Isong game) on functional probability learning) was answered. The result also shows that a Beta - value of .833 for main treatment (Nsa Isong) effect was obtained, indicating that the treatment accounted for 83.3 percent variance of scores on academic achievement in probability measures.

Hypothesis Two: There is no significant interactive effect of treatment (Nsa Isong game) and gender on students functional probability learning.

To test this hypothesis, analysis of covariance was applied to the data obtained from the respondents. The result as presented in Table 3 above, shows that there is significant interactive effect of treatment and gender $F(2, 139) = 13.541, (P < 0.05)$ on functional probability learning (academic achievement of students in probability). This result shows that male and female students differ significantly from one another when Nsa Isong game was used in the teaching and learning of probability. On the basis of this result, hypothesis 2 is rejected and the alternate hypothesis 2 is retained. To show the direction of difference, multiple classification analysis was applied to the data (see Table 4). The result indicated that adjusted mean (\bar{x}) scores for male and female groups are 33.94 and 32.56 respectively. Suggesting that male students performed better than their female counterparts. Hence, the research question 2 (what the interactive effects of treatment and gender on student functional probability is learning) was answered. The result also shows the beta value of 0.062 for treatment and gender was obtained, suggesting that treatment accounted for only 6.2 percent of variance of scores on academic achievement in probability measures.

Summary of Findings

1. There is a significant effect of Nsa Isong game on students functional probability learning.
2. There is a significant interactive effect of treatment and gender on students functional probability learning.

DISCUSSION OF FINDINGS

Effect of Nsa Isong game (Ethnomathematics) and student functional probability learning.

The results of the analysis based on the variable above showed that there is significant effect of Nsa Isong game on students functional probability learning. This finding is in line with Hammond (2000) and Orok (2013), They stated that ethnomathematics which is the mathematics of the learner's environment help in the learning of probability. Therefore, Nsa Isong game which comes from the domain of Ethnomathematics also help in the learning of probability vis-à-vis mathematics.

Effect of Nsa Isong game, gender and students functional probability learning.

The finding from the study indicated that there is significant effect of Nsa Isong game and gender on students functional probability learning. This finding is in consonant with the work of Blinkhorn (2006) who compare the mean of male and female students in the study. The analysis showed a significant gender difference with male having higher mean scores than female. In addition, Yoyobe (2004) and Ajibade (2009) in their studies observed significance effect of gender on students' academic performance in favour of female and male students respectively.

Summary of the Study

The study investigated “cultural variable and functional probability learning: An Ethnomathematics perspectives”. Nsa Isong game was used as major independent variable and functional probability learning as dependent variable. Two (2) objectives, research questions and null hypotheses were formulated for the study. The populations comprised of 3,610 students and sample size of 320 students. Quasi-experimental design of pretest and posttest was used. Probability Achievement Test (PAT) was the instrument used for data collection. The data collected were subjected to analysis of covariance (ANCOVA) for analysis. After the analysis the results indicated that; there is significant effect of Nsa Isong game on students functional probability learning, there is significant effect of Nsa Isong game and gender on students functional probability learning. The results also showed that Nsa Isong game and school location, Nsa Isong game, gender and school location do not have any significant effect on students functional probability learning.

Recommendations of the Study

Based on the findings of the study, the following recommendations were made;

1. Nsa Isong game should be made available to every primary and junior secondary schools.
2. Teacher should utilize them in the teaching of probability concepts.
3. Students should be allow to play with these game at their spare time or during break period.
4. There should be no disparity between the male and the female students. All of them should be allow to compete for their academic achievement and attainment.
5. Workshop and seminar should be organize for teachers at this level of education on how to use the Nsa Isong game in the teaching and learning of probability.

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